

THE MANAGEMENT OF NON-WOOD FOREST PRODUCTS IN BIHOR COUNTY

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Abstract

Bihor County is renowned for the quantity and quality of the non-wood forest products (NWFPs) harvested over time. Even if the potential of marketing of NWFPs is high, the focus is on timber production, that represents the main source of revenue for the forest owners. The aim of this research was to highlight the most important NWFPs from Bihor County.

Four categories of NWFPs and nineteen criteria proposed within the FP1203 COST Action European non-wood forest products network were taken into account. An Analytic Hierarchy Process (AHP) was used to evaluate the performance of selected alternatives by means of pairwise comparisons. The analyses were performed by using the Expert Choice Desktop software package.

*The non-wood forest products with the highest potential for Bihor County were the truffles (*Tuber spp.*) and the pheasant (*Phasianus colchicus L.*), while the less important ones were the flowers of the black elder (*Sambucus nigra L.*) and bear's garlic (*Allium ursinum L.*).*

Based on the results of this study, we conclude that Bihor County has a great potential for NWFPs mainly due to its great biodiversity as regards the forest ecosystems.

Key words: AHP, Bihor, mushrooms, truffles

INTRODUCTION

Forests form a very heterogeneous base of resources that provide a significant economic support to modern society, mainly by providing several types of raw materials, known as forest products. Over the ages, nature with its diverse flora was an important reservoir of raw material, needed by the masses to fulfill the living needs.

According to the experts of Food and Agriculture Organization (FAO), non-wood forest products (NWFPs), also known as non-timber forest products (NTFPs) consist of goods of biological origin other than wood, as well as services, derived from forests (FAO, 1999). This definition thus excludes all woody materials such as industrial roundwood, charcoal, fuelwood and different pieces of woods such as tools, household equipment and carvings.

Over the past two decades, an increasing number of institutions, governmental and non-governmental organizations, as well as the private sector, have become involved with the promotion and utilization of NWFPs.

A lot of new information has been collected on the socio-economic importance and potential of NWFPs utilization and their effects on the environment.

Commercial opportunities for NWFPs are emerging throughout the world as economic liberalization is opening new markets and governmental decentralization and democratization is enabling communities to have a greater role in the management of forest resources (Neumann et al., 2010).

NTFPs play also a crucial role in the daily life and welfare of the people all over the world. The importance of NWFPs is rather well known in developing countries, while in Europe and in particular in the European Union the role of NWFPs has neither been well analyzed nor recognized. In Europe, NWFPs merely entail functions related to a physical product that is harvested, and eventually processed and/or sold (Cesaro et al., 1995).

In Romania, according to the Forestry Code (Law 46/2008), the specific products of the national forest stock are the goods harvested from forests or other wooden lands, namely wood and non-wood products. Forests have traditionally played an important role in Romania's social and economic development over the years (Tutnock et al., 2007).

Due to its geographic location, varied climate, multiple forms of relief and soil types, Romania is rich in by-products (Herman, 2010). At national level, it is estimated that there are around 350 species of interest, NWFPs being mainly represented by forest fruits, mushrooms, game, and medicinal plants (Enescu, 2017).

Bihor County has a great potential in terms of collecting medicinal plants, forest fruits, edible mushrooms and forest seeds. In addition to timber, the forest stock offers a broad range of other well-exploited forest products as an important source of income for the Bihor Forestry Department and provides a large number of jobs for the population. In 2017, Bihor Forestry Department harvested the following forest products: *Boletus* sp. (10.20 tons), *Tilia* flowers (0.920 tons), fruits of *Rosa canina* L. (69.162 tons), flowers of *Sambucus nigra* L. (13.137 tons) and *Allium ursinum* L. (8.730 tons).

The main game species existing on the seven hunting grounds managed by Bihor Forestry Department are represented by: red deer (*Cervus elaphus* L.), fallow deer (*Dama dama* L.), roe deer (*Capreolus capreolus* L.), chamois (*Rupicapra rupicapra* L.) wild boar (*Sus scrofa* L.), brown hare (*Lepus europaeus* L.), pheasant (*Phasianuscolchicus* L.), capercaillie (*Tetrao urogalus* L.), partridge (*Perdixperdix* L.), quail (*Coturnix coturnix* L.), common snipe (*Gallinago gallinago* L.) and fieldfare (*Turdus pilaris* L.). In the hunting season 2016-2017, 36 individuals of brown hare and 134 pheasants were harvested, respectively.

The goal of this study was to highlight the most important NWFPs from Bihor County.

MATERIAL AND METHOD

The present study took into account the potential of Bihor County in terms of harvesting and marketing of NWFPs. This county which is located in the north-western part of Romania, along Crișul Repede and Crișul Negru rivers, bordered to the east by the Apuseni Mountains, and to the west by the Tisa Plain (Fig. 1).



Fig. 1. Location of Bihor County
(Source: <https://maps.ro/county>)

The total area of the forest stock in Bihor County is 209.300 hectares, of which 205.800 hectares are occupied by forests. The National Forest Administration Romsilva manages through Bihor Forestry Department 115.260 hectares, of which 61.170 hectares are the property of the Romanian state and 54.090 hectares belong to other owners.

The forest stock of Bihor County represents 27.7% of the total area of the county, from which 171.900 hectares (85.6%) are occupied by deciduous forests and 33.900 hectares (14.4%) are occupied with spruce forests (INS, 2016).

The continental-moderate climate is under the influence of western, more humid and cooler air masses. The average annual temperature varies between 6°C and 10.5°C, and the rainfall increases from west to east, ranging from 500 to 1200 mm (Șerban, 2013, 2015).

In this study, the Analytic Hierarchy Process (AHP), a multi-criteria decision making method that was originally developed by Prof. Thomas L.

Saaty, was used. Within AHP, the decision problem (*i.e.* the goal of this study) is decomposed into a hierarchy sub-problem (*i.e.* the criteria taken into consideration) which will be independently analyzed. Thus, AHP is a theory of measurement through pairwise comparisons and relies on the judgements of experts to derive priority scales (Saaty, 2008).

The NWFPs were grouped into four categories: Mushrooms, Understory plants, Tree products and Animal origin and for each category the most promising two NWFPs were selected. Nineteen criteria were taken into account and for each criterion a scale ranging from 1 to 8 was used, namely: 1: Harvesting period (1: the shortest harvesting period ... 8: the longest harvesting period); 2: Portfolio of derived products (1: the smallest number of derived products ... 8: the highest number of derived products); 4: Harvesting cost (1: the lowest cost ... 8: the highest cost); 5: Knowledge for recognition (1: most recognizable product ... 8: hardest recognizable product); 6: Knowledge for harvesting (1: the less knowledge necessary ... 8: most knowledge necessary); 7: Tools needed for harvesting (1: the least ... 8: the more); 8: Complexity of harvesting process (1: lowest ... 8: highest); 9: Distribution range (1: lowest ... 8: highest); 10: Market potential (1: low ... 8: high); 11: The price of raw product (1: lowest ... 8: highest); 12: The price of the derived product (1: lowest ... 8: highest); 13: Transport from the harvesting point to the storage center (1: the most easy ... 8: the most complicated); 14: Perishability (1: lowest ... 8: highest); 15: "Celebrity" of the product on the market (1: the least known ... 8: the most popular); 16: Market demand (1: lowest ... 8: highest); 17: Biotic threats (1: the fewest threats ... 8: the most threats); 18: Abiotic threats (1: the fewest threats ... 8: the most threats); 19: Development of the process of harvesting (1: undeveloped ... 8: extremely developed). This analysis model was proposed within the COST Action FP 1203 - *European non-wood forest products network* and it was used also in the case of other counties across Romania, such as Ialomița (Enescu, 2017) and Maramureș (Enescu et al., 2017). For each criterion, an explicit ranking of the alternatives (*i.e.* the eight selected NWFPs) was generated, based on experts' opinion and by using Expert Choice Desktop software package v. 11.5.1683.

RESULTS AND DISCUSSION

The selected NWFPs consisted in: truffles (*Tuber* sp.), *Boletus* sp., Tilia flowers, fruits of dog-rose (*Rosa canina* L.), flowers of black elder (*Sambucus nigra* L.), bear's garlic (*Allium ursinum* L.), pheasant (*Phasianus colchicus* L.) and hare (*Lepus europaeus* Pallas). The AHP alternative ranking, based on experts' opinion, is given in Table 1.

Table 1

AHP alternative ranking

Criterion	Mushrooms		Tree products	Understory plants			Animal origin	
	<i>Tuber sp.</i>	<i>Boletus sp.</i>	<i>Tilia flowers</i>	<i>Fruits of dog-rose</i>	<i>Flowers of black elder</i>	<i>Allium ursinum</i>	<i>Phasianus colchicus</i>	<i>Lepus europaeus</i>
1	5	8	1	4	3	2	7	6
2	8	5	4	7	6	1	2	3
3	1	4	7	6	5	8	2	3
4	8	5	4	3	2	1	7	6
5	8	7	3	4	5	6	2	1
6	8	5	2	4	3	1	7	6
7	6	3	5	4	2	1	8	7
8	8	4	5	3	2	1	7	6
9	5	6	1	7	2	3	4	8
10	8	7	5	6	4	1	3	2
11	8	7	4	3	2	1	5	6
12	8	7	4	2	3	1	5	6
13	4	5	1	6	2	3	8	7
14	8	5	2	3	4	1	7	6
15	8	7	4	3	2	1	6	5
16	8	7	1	6	3	2	4	5
17	6	5	1	4	2	3	7	8
18	8	7	6	4	5	3	2	1
19	6	3	4	5	2	1	8	7

According to AHP results, the non-wood forest products with the highest potential for Bihor County were the truffles and the pheasant, while the less important ones were flowers of black elder and bear's garlic (Fig. 2).

According to the results of this study, the mushrooms are among the most important NWFPs mainly due to their economic, ecologic and social value. Nowadays, mushroom picking became a widespread recreational activity in many regions, providing an alternative or complementary source of income to timber (Leonardi et al., 2017). Bihor County is renowned for the harvested quantities of truffles even though official statistics do not exist. Numerous truffle harvesters exist in this county especially in Aleşd or Lugaşu de Jos. Even though special truffles plantations exist in Romania (Dincă, Dincă, 2014), the truffles are still harvested from forests where they grow in mycotic symbiosis with the roots of certain trees or shrubs. Among these species, the most common ones are the oaks (*Quercus* spp.), hornbeam (*Carpinus betulus* L.), common beech (*Fagus sylvatica* L.), linden species

(*Tilia* spp.), hazel (*Corylus avellana* L.), etc. (Dincă, Dincă, 2011). The truffles are harvested with special trained dogs. The harvesting periods in Bihor County are: June-September for *Tuber aestivum* Vittad., October-December for *Tuber uncinatum* Chatin and September-December for *Tuber magnatum* Pico, respectively (Dincă, Dincă, 2012).

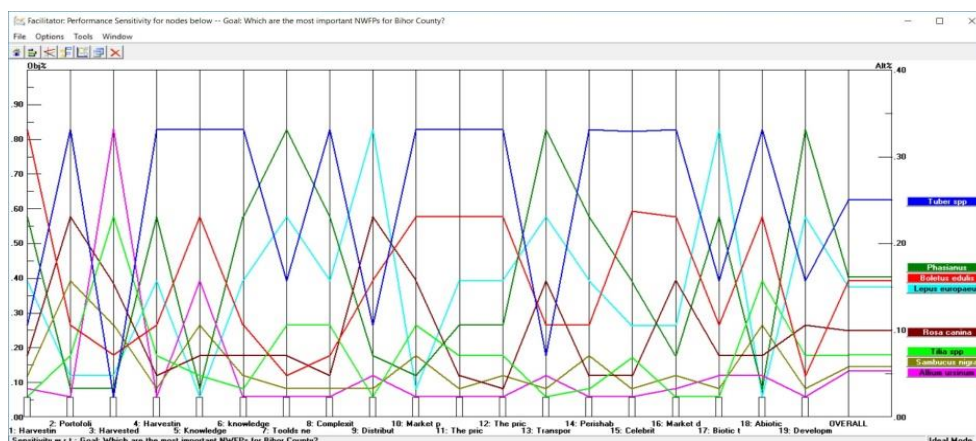


Fig. 2. Ranking of the selected NWFPs

As it was mentioned in other papers, penny bun is harvested in considerable amounts in Bihor County (Vasile et al., 2017). Its harvesting importance and tradition in the region could be also suggested if one takes into account the names of some localities from Bihor County (Dincă et al., 2016). By using the same methodology, it was found that penny bun ranked first also in Maramureş County (Enescu et al., 2017).

In Bihor County numerous medicinal plants are also harvested. Actually, according to a recent study (Vasile et al., 2016), Bihor, Tulcea and Vaslui counties are the main three providers of medicinal plants in the case of National Forest Administration Romsilva.

Even if black elder is a widespread species in Romania, having an ancient usage in scientific and popular medicine (Jianu et al., 2015; Enescu et al., 2016) and being used for remedy for colds, sinusitis and also for its laxative effect (Socaci et al., 2015), it ranked on the seventh position.

CONCLUSIONS

Bihor County is renowned for the quantity and quality of the NWFPs harvested over time. Thanks to its significant managed forest area, this county is the provider of numerous NFVPs, amongst which are the ones that were the subject of the study (truffles, penny bun, linden flowers, fruits of dog-rose, flowers of black elder, bear's garlic, pheasant and hare).

The truffles were the most promising non-wood forest products for Bihor County when all the 19 selected criteria received an equal importance. This means that if a forest contains all the selected eight NWFPs and a manager will take into account the proposed criteria, one of the best management measure will be to focus on harvesting and marketing of truffles. In order to have a lower impact as possible, special attention should be given to the harvesting methodology. Using trained dogs proved to be the best solution.

Last but not least, we believe that the results of this study should be regarded as a first and important step in analyzing the potential of certain forest products. Forest managers and forest owners may want to use this multi-criteria decision model in the future when they will have to take important decisions that will be focus on economic, social and environmental aspects.

REFERENCES

1. Dincă L., Dincă M., 2011, Trufele - o bogăție a ecosistemelor forestiere, prea puțin cunoscută de către silvicultori. *Cynegetic and Forestry Journal*, no. 29, pp.114-119
2. Dincă M., Dincă L., 2012, Recoltarea trufelor. *Cynegetic and Forestry Journal*, no. 30, pp.117-121
3. Dincă L., Dincă M., 2014, Considerații privind realizarea de plantații truifiere. *Cynegetic and Forestry Journal*, no. 34, pp.109-114
4. Dincă L., Enescu C.M., Dincă M., Cântar I.C., 2016, Mushrooms in Romanian toponymy, vocabulary and literature. *Journal of Horticulture, Forestry and Biotechnology*, Volume 20(3), pp.119-125
5. Enescu C.M., 2017, Which are the most important non-wood forest products in the case of Ialomița county? *AgroLife Scientific Journal*, Volume 6, Number 1, pp. 98-103
6. Enescu C.M., Houston Durrant T., Caudullo G., 2016, *Sambucus nigra* in Europe: distribution, habitat, usage and threats. *European Atlas of Forest Tree Species*. Publ. Off. EU, Luxembourg, pp.166-167
7. Enescu C.M., Dincă L., Vasile D., 2017, Importance of non-wood forest products for Maramureș County. *Cynegetic and Forestry Journal*, no. 40, pp.92-97
8. Grumeza N., Mercuriev O., Klepș Cr., 1989, Prognoza și programarea udărilor în sistemele de irigații. *Ceres Publishing House*, Bucharest, pp.162-164
9. Herman M., 2010, *Produse secundare ale pădurii*. University of Oradea Publishing House, pp.321
10. Jianu S., Buruiană D.L., Tănasie Ș.E., Chiriac A., 2015, The study of plant *Sambucus ebulus* L. (Caprifoliaceae) from spontaneous flora and its benefic obtained effects. *Agrarian Economy and Rural Development - Realities and Perspectives for Romania*, 6th Edition of the International Symposium, Bucharest, pp.228-232
11. Leonardi P., Graziosi S., Zambonelli A., Salerni E., 2017, The economic potential of mushrooms in an artificial *Pinus nigra* forest. *Italian Journal of Mycology*, volume 46, pp.48-59

12. Neumann R.P., Hirsch E., 2010, Commercialisation of Non-Timber Forest Products. Review and Analysis of Research, *International Forestry Research*, pp.187
13. Saaty T.L., 2008, The Analytic Hierarchy and Analytic Network Measurement Processes: Applications to Decisions under Risk. *European Journal of Pure and applied mathematics*, Volume 1, Number 1, pp.122-196
14. Socaci S.A., Fărcaș A.C., Tofană M., Pop C., Jimborean M., Nagy M., 2015, Evaluation of Bioactive Compounds from Flowers and Fruits of Black Elder (*Sambucus nigra* L.). *Bulletin UASVM Food Science and Technology*, 72(2), pp. 289-290
15. Șerban E., 2015, The heat wave in the Western Plain of Romania between the 6th and 8th July 2015. *Natural Resources and Sustainable Development*, Oradea, pp.155-164
16. Șerban E., Dragotă C.S., 2013, Long-term Variability of Precipitation and Air Temperature in Crisuri and Arad Plains. *Natural Resources and Sustainable Development*, Oradea, vol.5, pp.433-440
17. Tutnock D., Lawrence A., 2007, Romania's forests under transition: changing priorities in management, conservation and ownership. *Geographica Timisiensis*, 16 (1-2), pp.5-28
18. Vasile D., Dincă L., Voiculescu I., 2016, Recoltarea plantelor medicinale din flora spontană a fondului forestier administrat de RNP Romsilva. *Cynetic and Forestry Journal*, no.37, pp.88-94
19. Vasile D., Dincă L., Enescu M., 2017, Impact of collecting mushrooms from the spontaneous flora on forest ecosystems in Romania. *AgroLife Scientific Journal*, Volume 6, Number 1, pp.268-275
20. ***, 1999, Towards a harmonized definition of non-wood forest products. *Unasylva*, FAO, 50(198), pp.63-64
21. ***, 2016, Suprafața fondului forestier pe categorii de terenuri și specii de păduri, macroregiuni, regiuni de dezvoltare și județe. National Institute of Statistics (INS), <http://statistici.insse.ro>

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